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US-UKRAINE COOPERATION IN THE MPC&A FIELD
AT THE KIEV INSTITUTE FOR NUCLEAR RESEARCH**

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Results and Experience of 10 Years of US-Ukraine Cooperation in the MPC&A Field at the Kiev Institute for Nuclear Research

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ABSTRACT

The Institute for Nuclear Research of the Academy of Sciences of Ukraine was the first Ukrainian organization to begin the implementation of Agreements of October 25 and December 18, 1993 between Ukraine and the US.

Over a relatively short period of time and with the financial, technical and methodological assistance of the US DOE, the Institute for Nuclear Research was able to develop a modern system of physical protection of nuclear materials and its Research Reactor. The rapid progress of this work was aided by the diligence of the US-Ukraine group (Argonne and Sandia National Labs and the Institute for Nuclear Research) under the supervision of George Kuzmycz, a US DOE employee, and prompt resolution of numerous issues by the government authorities of the USA and Ukraine. The fresh fuel and nuclear materials storage were established in full compliance with international requirements. A modern MC&A system was developed at the Institute for Nuclear Research with the US assistance as well.

The experience gained during the work with the Institute for Nuclear Research was used successfully by the US and Ukrainian parties at other nuclear facilities of Ukraine.

The advanced training of Ukrainian specialists organized by the US DOE has played a very important role in the efficient use of the US Government assistance. Later on the Training Center for Physical Protection, Control and Accounting of Nuclear Material, named in honor of the late George Kuzmycz, was established at the Institute for Nuclear Research with the US assistance as well.

INTRODUCTION

This summer it will be 10 years since the actual joint US-Ukrainian work in the field of nuclear materials and facilities accounting, control and physical protection has commenced. Here is the background information about the effort.

The country of Ukraine gained independence on August 24, 1991. At that time the country was third (after the US and Russian Federation) in nuclear military capacity and had 5 nuclear power

plants, including Chernobyl, nuclear materials in bulk, uranium ore production facility and a uranium ore conversion facility.

One of the most acute and urgent challenges encountered by the leadership of Ukraine at that time was the need to ensure the security of the nuclear weapons then deployed in the country as well as that of nuclear materials and nuclear facilities employed for peaceful uses.

Scientific research, support and design organizations along with the nuclear weapons manufacturers remained in Russia after the disintegration of the Soviet Union. Thus, Ukraine faced a dilemma: to decide not to have her own nuclear weapons or to develop a national nuclear military infrastructure. The latter contradicted Ukraine's political intentions to become a nuclear weapons-free state and, furthermore, was economically impractical. Ukraine's commitment to eliminate its nuclear arsenal was fulfilled when the last such weapons left her territory in 199x.

Ukraine could not become completely non-nuclear, however. Fifteen commercial nuclear reactors generated over 40% of the overall national electricity output and the country had no generating capacity to compensate for shutting down the nuclear power plants.

Thus, the country urgently needed to develop her own infrastructure to support the operation both of the power and research reactors. A national nuclear regulatory authority along with agencies that manage nuclear facility operational control and nuclear safety were rapidly stood up and the relevant national legal and regulatory framework was developed. The most important task at that time was to organize the accounting and control of nuclear materials and the physical protection of nuclear facilities. Resources to accomplish these tasks were scarce: hyperinflation, skyrocketing unemployment, businesses failures en masse and the brain drain abroad had decimated the economy. Conditions at Ukrainian enterprises raised serious concerns upon which the nation's leaders, the UN, the IAEA and a number of countries focused attention. On 25 October 1993, the agreement was signed between Ukraine and the United States of America on provision of assistance to Ukraine in the elimination of strategic nuclear arms and in the prevention of proliferation of weapons of mass destruction. In a follow up effort to the above, on December 18, 1993, the Implementing Agreement was signed by the State Committee of Ukraine for Nuclear and Radiation Safety and the Department of Defense of the United States with the view to assist Ukraine in the development of its state systems of control, accounting, and physical protection of nuclear materials to promote the prevention of nuclear weapons proliferation from Ukraine.

The State Committee of Ukraine for Nuclear and Radiation Safety identified 4 nuclear facilities in Ukraine as the first priority venues for implementation of the Agreement. These facilities are:

- ✓ Kiev Institute for Nuclear Research (KINR) of the National Academy of Sciences of Ukraine (VVR-M research reactor)
- ✓ National Scientific Center Kharkov Institute of Physics and Technology of the National Academy of Sciences of Ukraine (KIPT, a bulk nuclear materials facility)
- ✓ Sevastopol National Institute of Nuclear Energy and Industry (SNINEI, which operates a research reactor)
- ✓ South Ukraine Nuclear Power Plant (SUNPP)

This report will focus primarily on translating into reality the December 18, 1993 Implementing Agreement as it pertains to KINR. In retrospect, it could be said that work performed at the Institute to implement provisions of the Agreement is a good example of successful and effective cooperation.

SOME INFORMATION ABOUT KINR

Listed below are the main areas of KINR's scientific work:

- ✓ Nuclear physics
- ✓ Nuclear energy
- ✓ Solid state physics and radiation physics
- ✓ Plasma physics
- ✓ Radiology and radiobiology

The Institute employs 750 people including 200 researchers. The equipment available at the Institute for experimental work is:

- ✓ Isochronous cyclotron
- ✓ Research reactor
- ✓ Classic cyclotron
- ✓ Tandem type electrostatic generator
- ✓ A range of hot cells for highly radioactive materials

The employees of KINR made a sizeable contribution to the elimination of the effects of the accident at the Unit 4 of the Chernobyl Power Plant. The Institute has gained a great deal of experience in mitigating the effects of large-scale accidents such as that at Chernobyl.

The above emphasizes the fact that, when US-Ukrainian cooperation in the area of nuclear materials accounting, control and physical protection began, the Institute had already accumulated considerable work expertise in the field of nuclear science and technology. However, it is important to note that Ukraine's nuclear materials protection, control, and accounting standards and practices, were significantly behind the applicable international standards.

Technical means, equipment and protection barriers at the research reactor facility were designed and put into operation in the late 1950s, but they could function no longer as an effective line of defense against the theft of nuclear materials or an act of sabotage at the facility. Thus, the only real force capable of providing this defense were the research reactor facility personnel and its guard. And, thank God, that they were able to do that.

This was what the members of the first American mission, headed by the late George Kuzmycz, saw when they arrived in our Institute exactly 10 years ago to conduct a site survey at the Kiev Nuclear Research Institute and to put together a plan to implement the provisions of the Agreement of December 18, 1993.

IMPLEMENTATION OF THE 18 DECEMBER 1993 AGREEMENT

Due to the effective composition of the US Mission and that of the Institute's working group, the joint Ukrainian-American team was able from the first hours of cooperation to bring about a spirit of creativity, an unbiased approach, and, most importantly, mutual trust.

We are of the opinion that the trust in an international team is the decisive factor behind the effective resolution of any task, and that this is specifically true when the issues in question are so "sensitive" as the accounting, control and physical protection of nuclear materials. Ten years ago, physical protection requirements for nuclear materials and facilities were still in formulation, and that could have hampered the design of the research reactor's physical protection systems. However, this never happened because the Ukrainians proposed to base the design on US standards, regulations, and requirements. The American side agreed to this proposal. This joint decision made it

possible to minimize the development time for the physical protection system and to get down to the actual implementation of the project.

Sandia and Argonne National Laboratories of the US Department of Energy and ADVANTOR Company specialists participated in the development and installation of the physical protection systems. KINR specialists participated at all stages of design, construction, installation, and setup of the reactor's physical protection systems. This allowed Ukrainian specialists to master the unfamiliar equipment during the process of assembly and adjustment and to expedite the work significantly, thereby reducing its cost. KINR's research reactor was the first facility in Ukraine at which the provisions of the US-Ukraine cooperation in the field of MPC&A were implemented. In the process, many issues related to taxation, customs clearance of incoming cargo from the US, protection of confidential information, and other issues were worked out in the process of this work. This experience was subsequently used at other facilities in Ukraine.

Difficulties that arose in the process of implementing the joint work objectives were resolved successfully by the management of the US DOE and the government agencies of Ukraine, particularly Ukraine's nuclear regulatory body. Ukraine developed and implemented a number of legislative documents without which implementation of the Agreement of October 25, 1993, would have been impossible.

In 1997, within the framework of the Nunn-Lugar Program, KINR completed and commissioned the physical protection system for the reactor and its refurbished fresh fuel storage rooms. A modern MC&A system was developed. The Institute trained its first specialists in the maintenance of the physical protection systems.

By this time, similar work had begun at the other three facilities (SNINEI, KIPT, and SUNPP) and certain issues naturally arose. One of these issues was the need for advanced training of Ukrainian MPC&A specialists. Two goals were set at the same time:

1. Training Ukrainian specialists in the modern approaches and methods of MPC&A;
2. Reinforcing the necessity that each attendee strictly observes the existing standards and rules governing their activities.

The first training courses were presented in KINR in 1996 by US lecturers and instructors. These courses were taught in poorly equipped facilities, without the use of modern presentation equipment or copiers; training materials for the students were delivered from the USA. Nevertheless, the attendees yearned for new knowledge because they needed it to successfully perform their professional duties. It was necessary to establish a structure in Ukraine that focused on the organization and presentation of training courses to improve the professional skills of Ukrainian MPC&A specialists. At the request of the Ukrainian side, the US DOE allocated funds, materials, and personnel to establish a Training Center for Material Protection, Control, and Accounting in Ukraine. The DOE's program manager, George Kuzmycz, made a huge contribution in the establishment of the Center. He helped shape the future directions of the Center, develop procedures by which US specialists shared knowledge with their Ukrainian counterparts, and determined the topics of the training courses.

Unfortunately, his early tragic demise prevented him from implementing these plans in person. However, this vision was fulfilled by his US and Ukrainian colleagues. Unanimously, they decided to name the Center after George Kuzmycz. Its grand opening was held on October 8, 1998.

Other presentations prepared for this conference will provide information on the Center's operation, its issues and tasks in the two main directions of its activities. We cite only the main results of the Center's activities:

1. The Center cooperates successfully with departments of Los Alamos, Sandia, Argonne, Pacific Northwest, and Brookhaven National Laboratories in the USA. Specialists from these laboratories provide high-quality instruction to Ukrainian specialists at the Center.
2. The Center became one of the structural elements of state systems of physical protection of nuclear material and nuclear facilities and assumes the responsibility for advanced training and qualification improvement of Ukrainian specialists. This has a favorable effect on their performance in the field.
3. The Center managed to shape a motivated team of teachers – employees of KINR-and of other Ukrainian organizations.
4. The Center began developing its own training materials and courses.
5. Thanks to the assistance from the US DOE, the Center has been receiving new teaching aids and means and upgrading the existing ones.
6. This year, Los Alamos National Laboratory of the US DOE helped establish a nuclear materials non-destructive assay laboratory.

There are other aspects of the Center's activities, in addition to the training. The Center provides maintenance at Ukrainian nuclear facilities of the physical protection equipment made by ADVANTOR Corporation. The Center also is engaged in the implementation at Ukrainian nuclear facilities of the AIMAS automated MC&A system developed by Argonne National Laboratory.

Over the entire ten years of US-Ukraine cooperation, the US side, upon the requests from Ukrainian side pays serious attention to the support and upgrading of physical protection systems at the research reactor. Just this year, pursuant to the contracts concluded with Sandia National Laboratories, the Center has purchased, installed and commissioned a new CCTV subsystem, alarm signal evaluation improvements, an uninterrupted power supply unit, and upgrades to the access control point on the perimeter.

A detachment of Internal Troops of the Ministry of Internal Affairs of Ukraine provides security guards for the research reactor. With US assistance, operators and technicians working with ADVANTOR equipment improve their qualification in the Training Center on an ongoing basis. This year, the Center built and commissioned a new classroom for training the guard force at the Kiev Institute for Nuclear Research.

The Institute's research reactor uses high-enriched fuel (36% and 90% ^{235}U). Many fuel assemblies have accumulated in the spent fuel storage tank, and none of them has been removed from the reactor for 15 years. A resolution to this problem is now being achieved. Since last year, the Institute has taken part in a joint program of the USA, IAEA, Russia, and Ukraine to return high-enriched fuel to the country of its origin and to switch the reactor fuel to low-enriched. Argonne National Laboratory represents the USA in this program. The work has just started and there is much yet to do before this program has reached a successful conclusion.

The Center also has problems affecting the quality of training:

1. A shortage of classrooms equipped for MPC&A practical training.
2. Professional training to improve the skills of the Center's Ukrainian lecturers and instructors is still needed.

We envision resolving these issues and challenges by extending the range of the Center's services in organizing MPC&A training for Ukrainian specialists, organizing training for NIS specialists, thereby transforming the Center from a national into an international (regional) center. This January, in Kiev, a conference was organized to determine the training needs of MPC&A

specialists in the Newly Independent and Baltic states. Representatives of the ten countries participating in the conference expressed their desire to train their specialists in Kiev.

Speaking about the past and the present, it is important to think about the future as well, and in this particular case, think about the tasks that the George Kuzmich Training Center (GKTC) has to accomplish. Here are some of those tasks:

- Arrange the systematic work in the area of advanced training of the Ukrainian specialists in the field of nuclear material accounting, control and physical protection (high and medium level personnel, around 150 individuals).
- Train members of nuclear facilities as trainers for the on-site education of the middle and lower level specialists in nuclear materials control, accounting and physical protection.
- Satisfy the needs in specialist training of CIS and Baltic states (Azerbaijan, Armenia, Belarus, Georgia, Kyrgyzstan, Tajikistan, Uzbekistan and, possibly, Kazakhstan, Latvia and Lithuania). The first seven countries are in the urgent need of training of their personnel.

In order to implement such tasks, the GKTC needs to:

- Develop training and presentation material to cover 15-18 courses in physical protection and 9-12 courses in nuclear materials accounting and control.
- Advance train the GKTC Ukrainian instructors (8-10 physical protection trainers, 6-8 nuclear materials accounting and control instructors).
- Arrange the training "grounds" facility at the site of Kiev Institute for Nuclear Research (KINR) and a training class at GKTC to conduct practical exercises in physical protection and install needed equipment there.
- Arrange a nuclear material accounting and control training class at the GKTC with relevant equipment infrastructure.

The probability of translating these plans into reality is greatly contingent on the attitude of the US DOE to such plans.

SUMMARY

Thus, the example of KINR allows us to say that US-Ukrainian cooperation and US MPC&A assistance to Ukraine has been implemented successfully and significant contributions have been made to the non-proliferation of nuclear weapons. Along with this, we, at the KINR and its GKTC realize, that there is great deal of work ahead of us that we need to do in order to make our modest contribution into the implementation of the nuclear weapons non-proliferation activity, which is the most acute and important world problem of today.